

EDITORIAL

Global Aerosol Climatology Project

Tropospheric aerosols are thought to cause a significant direct and indirect forcing of climate, but the magnitude of this forcing remains highly uncertain because of inadequate knowledge of global aerosol characteristics and their temporal changes. To address this complex issue in a coordinated and coherent way, the National Aeronautics and Space Administration Radiation Sciences Program and the Global Energy and Water Cycle Experiment (GEWEX) established in 1998 a joint program called the Global Aerosol Climatology Project (GACP). The main objectives of GACP are to 1) analyze satellite radiance observations and field measurements in order to infer the global distribution of aerosol properties and their seasonal and interannual variations, and 2) perform advanced modeling studies of the aerosol formation, processing, and transport. The ultimate goal of the project is to develop advanced global aerosol climatologies for the full period of available satellite data suitable for use in studies of the direct and indirect effects of aerosols on climate and to make these climatologies broadly available.

Preliminary results of the project were discussed at three Science Team meetings (in New York City in 1998 and 1999 and Lanham-Seabrook, Maryland, in 2000) as well as at special sessions of the Fall Meeting of the American Geophysical Union (San Francisco, California, 1999) and the Annual Meeting of the American Meteorological Society (Albuquerque, New Mexico, 2001). GACP also sponsored a workshop on the indirect aerosol effect held in 2000 in New York City. (Detailed information about the project can be found online at <http://gacp.giss.nasa.gov>.)

This special issue is intended to summarize the principal results of the initial 3-yr phase of GACP. Although most of the papers included have been contributed by GACP Science Team members, the issue was open to any papers reporting on significant new developments in physics and chemistry of atmospheric aerosols.

GACP was designed from the outset to be highly collaborative, as demonstrated by the long author lists of many of the papers included in this special issue, and brought together scientists with a wide range of expertise in the physics and chemistry of aerosols and clouds. The research performed in the framework of GACP has resulted in significant progress in development of multichannel aerosol retrieval algorithms, critical assessment of the potential information content of the existing satellite datasets and their limitations, quantifying differences in aerosol scenarios predicted by different modeling groups, and using field data for validating satellite and modeling results. The project has highlighted the complexity of the indirect aerosol effect on climate and the necessity of a comprehensive approach to address this problem. The expected result of the initial phase of GACP will be three satellite climatologies of aerosol optical thickness and size [based on one- and two-channel Advanced Very High Resolution Radiometer (AVHRR) retrievals and on Total Ozone Mapping Spectrometer (TOMS) data] and potentially several climatologies based on various transport–chemistry models. Given significant calibration uncertainties in the AVHRR data, the inherent limitations of one- and two-channel retrieval strategies, and the scarcity of ground-truth data over the oceans, the satellite climatologies may need to be recalibrated by using global moderate resolution imaging spectroradiometer (MODIS) and multiangle imaging spectroradiometer (MISR) results as well as more advanced aerosol retrievals based on photopolarimetric measurements as benchmarks. A concerted effort will be required to merge all satellite and modeling products into a unified aerosol climatology suitable for use in global circulation models.

We commend the authors for their efforts in preparing the manuscripts included in this special issue and the reviewers for the willingness to provide their time and expertise, sometimes on very short notice. We thank Kuo-Nan Liou and the staff of the *Journal of the Atmospheric Sciences* for their help in organizing and preparing this special issue. It is hoped that the readers will find this representative collection of papers a useful and stimulating update on the subject of physics and chemistry of atmospheric aerosols and their forcing of climate.

Michael Mishchenko
Joyce Penner
Donald Anderson
Guest Editors